

```

> restart
> Sistema := diff(x[1](t), t) = x[1](t) + 2·x[2](t), diff(x[2](t), t) = 4·x[1](t) + 3·x[2](t) :
    Sistema[1]; Sistema[2]

```

$$\frac{d}{dt} x_1(t) = x_1(t) + 2 x_2(t)$$

$$\frac{d}{dt} x_2(t) = 4 x_1(t) + 3 x_2(t) \quad (1)$$

```

> CondIni := array([_C1, _C2])

```

$$CondIni := \begin{bmatrix} _C1 & _C2 \end{bmatrix} \quad (2)$$

```

> AA := array([[1, 2], [4, 3]])

```

$$AA := \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix} \quad (3)$$

```

> with(linalg) :
> MatExp := exponential(AA, t)

```

$$MatExp := \begin{bmatrix} \frac{2 e^{-t}}{3} + \frac{e^{5t}}{3} & \frac{e^{5t}}{3} - \frac{e^{-t}}{3} \\ \frac{2 e^{5t}}{3} - \frac{2 e^{-t}}{3} & \frac{e^{-t}}{3} + \frac{2 e^{5t}}{3} \end{bmatrix} \quad (4)$$

```

> SolGral := evalm(MatExp &* CondIni)
SolGral :=

```

$$\left[\left(\frac{2 e^{-t}}{3} + \frac{e^{5t}}{3} \right) _C1 + \left(\frac{e^{5t}}{3} - \frac{e^{-t}}{3} \right) _C2, \left(\frac{2 e^{5t}}{3} - \frac{2 e^{-t}}{3} \right) _C1 + \left(\frac{e^{-t}}{3} + \frac{2 e^{5t}}{3} \right) _C2 \right] \quad (5)$$

```

> SolGralFinal := x[1](t) = SolGral[1], x[2](t) = SolGral[2] : SolGralFinal[1];
    SolGralFinal[2]

```

$$x_1(t) = \left(\frac{2 e^{-t}}{3} + \frac{e^{5t}}{3} \right) _C1 + \left(\frac{e^{5t}}{3} - \frac{e^{-t}}{3} \right) _C2$$

$$x_2(t) = \left(\frac{2 e^{5t}}{3} - \frac{2 e^{-t}}{3} \right) _C1 + \left(\frac{e^{-t}}{3} + \frac{2 e^{5t}}{3} \right) _C2 \quad (6)$$

```

> ComprobarUno := simplify(eval(subs(x[1](t) = rhs(SolGralFinal[1]), x[2](t)
    = rhs(SolGralFinal[2]), lhs(Sistema[1]) - rhs(Sistema[1]) = 0)))

```

$$ComprobarUno := 0 = 0 \quad (7)$$

```

> ComprobarDos := simplify(eval(subs(x[1](t) = rhs(SolGralFinal[1]), x[2](t)
    = rhs(SolGralFinal[2]), lhs(Sistema[2]) - rhs(Sistema[2]) = 0)))

```

$$(8)$$

$$\text{ComprobarDos} := 0 = 0 \quad (8)$$

> restart

> Sistema := diff(x[1](t), t) = -7·x[1](t) + x[2](t) + exp(2·t), diff(x[2](t), t) = -2·x[1](t) - 5·x[2](t) : Sistema[1]; Sistema[2]

$$\frac{d}{dt} x_1(t) = -7 x_1(t) + x_2(t) + e^{2t}$$

$$\frac{d}{dt} x_2(t) = -2 x_1(t) - 5 x_2(t) \quad (9)$$

> CondIni := array([-6, 4])

$$\text{CondIni} := \begin{bmatrix} -6 & 4 \end{bmatrix} \quad (10)$$

> BB := array([exp(2·t), 0])

$$\text{BB} := \begin{bmatrix} e^{2t} & 0 \end{bmatrix} \quad (11)$$

> AA := array([[-7, 1], [-2, -5]])

$$\text{AA} := \begin{bmatrix} -7 & 1 \\ -2 & -5 \end{bmatrix} \quad (12)$$

> XX := array([x[1](t), x[2](t)])

$$\text{XX} := \begin{bmatrix} x_1(t) & x_2(t) \end{bmatrix} \quad (13)$$

> with(linalg) :

> MatExp := exponential(AA, t)

$$\text{MatExp} := \begin{bmatrix} e^{-6t} \cos(t) - e^{-6t} \sin(t) & e^{-6t} \sin(t) \\ -2 e^{-6t} \sin(t) & e^{-6t} \cos(t) + e^{-6t} \sin(t) \end{bmatrix} \quad (14)$$

> SolHom := evalm(MatExp &* CondIni)

$$\text{SolHom} := \begin{bmatrix} -6 e^{-6t} \cos(t) + 10 e^{-6t} \sin(t) & 16 e^{-6t} \sin(t) + 4 e^{-6t} \cos(t) \end{bmatrix} \quad (15)$$

> SolHomUno := x[1](t) = SolHom[1]

$$\text{SolHomUno} := x_1(t) = -6 e^{-6t} \cos(t) + 10 e^{-6t} \sin(t) \quad (16)$$

> SolHomDos := x[2](t) = SolHom[2]

$$\text{SolHomDos} := x_2(t) = 16 e^{-6t} \sin(t) + 4 e^{-6t} \cos(t) \quad (17)$$

> MatExpTau := map(rcurry(eval, t='t - tau'), MatExp)

MatExpTau := (18)

$$\begin{bmatrix} e^{-6t+6\tau} \cos(t-\tau) - e^{-6t+6\tau} \sin(t-\tau) & e^{-6t+6\tau} \sin(t-\tau) \\ -2 e^{-6t+6\tau} \sin(t-\tau) & e^{-6t+6\tau} \cos(t-\tau) + e^{-6t+6\tau} \sin(t-\tau) \end{bmatrix}$$

> BBtau := map(rcurry(eval, t='tau'), BB)

$$\text{BBtau} := \begin{bmatrix} e^{2\tau} & 0 \end{bmatrix} \quad (19)$$

> ProdTau := evalm(MatExpTau &* BBtau)

$$\text{ProdTau} := \begin{bmatrix} (e^{-6t+6\tau} \cos(t-\tau) - e^{-6t+6\tau} \sin(t-\tau)) e^{2\tau} & -2 e^{-6t+6\tau} \sin(t-\tau) e^{2\tau} \end{bmatrix} \quad (20)$$

> *SolNoHom* := *map(int, ProdTau, tau = 0 .. t)*
SolNoHom := (21)

$$\left[-\frac{7 e^{-6 t} \cos(t)}{65} + \frac{9 e^{-6 t} \sin(t)}{65} + \frac{7 e^{2 t}}{65} \quad \frac{2 e^{-6 t} \cos(t)}{65} + \frac{16 e^{-6 t} \sin(t)}{65} - \frac{2 e^{2 t}}{65} \right]$$

> *SolFinal* := *x[1](t) = rhs(SolHomUno) + SolNoHom[1], x[2](t) = rhs(SolHomDos)*
+ *SolNoHom[2] : SolFinal[1]; SolFinal[2]*

$$x_1(t) = -\frac{397 e^{-6 t} \cos(t)}{65} + \frac{659 e^{-6 t} \sin(t)}{65} + \frac{7 e^{2 t}}{65}$$

$$x_2(t) = \frac{1056 e^{-6 t} \sin(t)}{65} + \frac{262 e^{-6 t} \cos(t)}{65} - \frac{2 e^{2 t}}{65} \quad (22)$$

> *Sistema[1]; Sistema[2]*

$$\frac{d}{dt} x_1(t) = -7 x_1(t) + x_2(t) + e^{2 t}$$

$$\frac{d}{dt} x_2(t) = -2 x_1(t) - 5 x_2(t) \quad (23)$$

> *ComprobarUno* := *simplify(eval(subs(x[1](t) = rhs(SolFinal[1]), x[2](t)*
= *rhs(SolFinal[2]), lhs(Sistema[1]) - rhs(Sistema[1]) = 0))*)

$$\text{ComprobarUno} := 0 = 0 \quad (24)$$

> *ComprobarDos* := *simplify(eval(subs(x[1](t) = rhs(SolFinal[1]), x[2](t)*
= *rhs(SolFinal[2]), lhs(Sistema[2]) - rhs(Sistema[2]) = 0))*)

$$\text{ComprobarDos} := 0 = 0 \quad (25)$$

> *CondIni[1]*

$$-6 \quad (26)$$

> *ComprobarTres* := *simplify(subs(t = 0, SolFinal[1]))*

$$\text{ComprobarTres} := x_1(0) = -6 \quad (27)$$

> *CondIni[2]*

$$4 \quad (28)$$

> *ComprobarCuatro* := *simplify(subs(t = 0, SolFinal[2]))*

$$\text{ComprobarCuatro} := x_2(0) = 4 \quad (29)$$

>